

Cryogenic Reservoir Inventory by Cost-Effective Kinetically Enhanced Technology (CRICKET)

Completed Technology Project (2015 - 2016)



Project Introduction

CRICKET will employ a novel mobility concept to explore permanently shadowed regions (PSR) on the Moon. The volatiles stored in lunar polar areas and on other bodies are important not only for science, but also for exploration in the context of in situ resource utilization (ISRU). CRICKET considers different architectures for simple, relatively inexpensive robots operating as members of a hive to explore PSR, locate areas where water ice is at or near the surface, and relays this information to Earth. CRICKET considers various approaches to moving about on the surface in this biomimetic approach: crawlers, hoppers, and small soccer-ball style buckey-bot concept in which several of the faces act as pads to propel the bot across the surface. In the APL Buckbot, one face is equipped with sensors to search for the presence of water and other volatiles as both free compounds and bound species. The CRICKET concept consists of three elements, each kept as simple as possible: an orbiter (the "queen" for delivery, location, and communication), a carrier (the "hive" for data collection, navigation, power, and dispersal on the surface), and the 'crickets'. Each element is a reasonable extrapolation of existing cubesat and/or commercial technology. Each cricket carries a tiny SWIR and Far UV MEMS spectrograph, xenon lamp, heating element 'proboscis' and 'whiskers' for characterizing the volatiles. We use multiple crickets to achieve a high-resolution map and to mitigate risk of failure.

Anticipated Benefits

Understanding volatiles on planetary bodies is important to both the Science Mission Directorate (SMD) and Human Exploration and Operations Mission Directorate (HEOMD), but for different reasons. SMD is interested because the volatiles trapped different bodies record the processes of accretion and that varied with space and time; volatile release from the interior indicating how the bodies evolved; and they record the history of the Sun. CRICKET will detect the presence of the volatiles and establish their geological context. HEOMD's interest lies in the use of different volatiles for use in life support and for fuel. CRICKET will establish presence of the materials needed for ISRU, thus enabling the arrival of humans. CRICKET will enable a reduced-risk sample return mission by producing pathfinding information so that an eventual complex rover/sample acquisition mission can be safely executed. The form and distribution of H₂O/OH, as well as other minerals and geologic structures will be available for planning and scientific analysis. A current real-world benefit of this study is disaster recovery efforts. There are robots [8] that can find people trapped in rubble but they are: large, costly, slow, require trained operators, expensive, and most importantly, rare. Only one such robot is used at a time. CRICKET charts a course for the development of tool that would consist of dozens of insect-like devices that scurry through rubble looking for survivors at low-cost and without needing a highly skilled operator. Each of these survivor-locators would then flag the location of a survivor just



Cryogenic Reservoir Inventory
by Cost-Effective Kinetically
Enhanced Technology

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destination	3

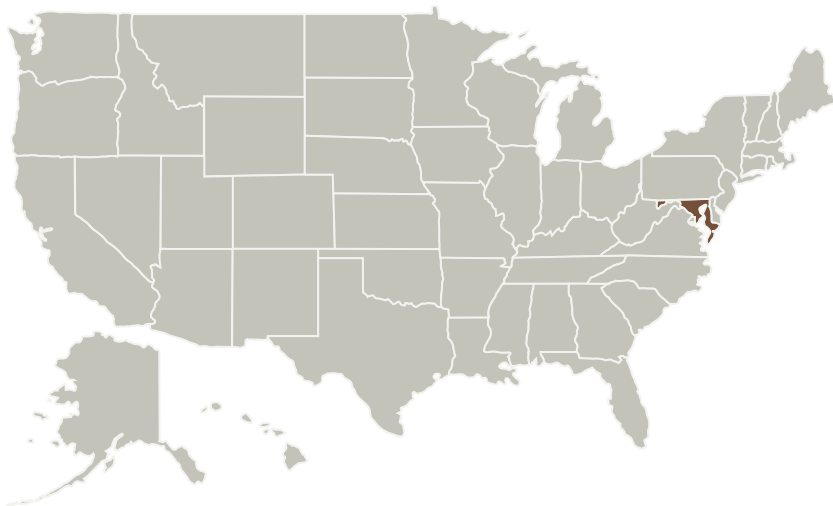
Cryogenic Reservoir Inventory by Cost-Effective Kinetically Enhanced Technology (CRICKET)

Completed Technology Project (2015 - 2016)



as crickets will flag the location of resources. By fractionating the search from the rescue function, economies of scale can be realized. CRICKET will do something analogous to this on the lunar surface.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Johns Hopkins University Applied Physics Laboratory (JHU/APL)	Lead Organization	R&D Center	Laurel, Maryland
Johns Hopkins University	Supporting Organization	Academia	Baltimore, Maryland

Primary U.S. Work Locations

Maryland

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Johns Hopkins University Applied Physics Laboratory (JHU/APL)

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

Eric A Eberly

Principal Investigator:

Larry J Paxton

Co-Investigators:

Charles A Hibbitts
Margaret A Darrin

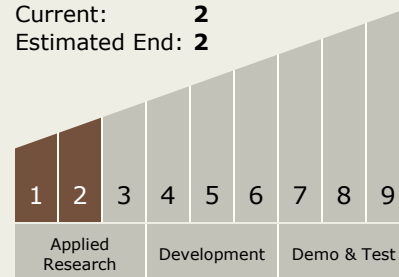
Cryogenic Reservoir Inventory by Cost-Effective Kinetically Enhanced Technology (CRICKET)

Completed Technology Project (2015 - 2016)



Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.1 Destination Reconnaissance and Resource Assessment

Target Destination

Mars